**Batting Averages**

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| This lesson focuses on subtraction of quantities to the thousandths place. The context of this lesson involves the batting averages of players. |

**NC Mathematics Standards:**

**Compute and solve real-world problems with multi-digit whole numbers and decimal numbers.**

**NC.5.NBT.7** Compute and solve real-world problems with multi-digit whole numbers and decimal numbers.

* Add and subtract decimals to thousandths using models, drawings or strategies based on place value.
* ~~Multiply decimals with a product to thousandths using models, drawings, or strategies based on place value.~~
* ~~Divide a whole number by a decimal and divide a decimal by a whole number, using repeated subtraction or area models. Decimals should be limited to hundredths.~~
* Use estimation strategies to assess reasonableness of answers

**Standards for Mathematical Practice:**

1. Make sense of problems and persevere in solving them.

4. Model with mathematics.

6. Attend to precision.

**Student Outcomes:**

* I can determine whether I need to add or subtract numbers in a word problem.
* I can use estimation strategies to assess the reasonableness of my answers.

**Math Language:**

* Decimal, tenths, hundredths, thousandths, sum, estimate

**Materials:**

* Batting Average activity sheet, paper, pencil, colored pencil, grid paper, “What Do You See?” images to project

**Advance Preparation**:

* Gather materials
* Work through using the decimal squares to model a problem. You may want to prepare the model for finding the difference between Fredrick’s and Romeo’s batting averages to use in the lesson.

**Launch:**

1. What Do You See?

* Tell students you will be showing a quick image of a grid. Ask students what they know about grid paper from fourth grade (We used grids to represent decimal, a grid can be made up of ten rows and ten columns or 100 squares. )
* Display the images in What Do You See? one at a time.
* For each image show the image for 2 seconds then remove it.
* Ask students to describe to their neighbor what they saw.
* Show the image again for 5 seconds and have students to once again describe what they see.
* Display the image, bring the class together, and ask:
  + “How many boxes were shaded?”
  + “If the whole square has a value of 1 what is the value of the amount shaded?”
  + “How do you know?”
  + “Is your answer reasonable? How do you know?”
  + “What are some equations we can write for this picture?”

1. Introduce the task.

* Distribute the activity sheet.
* Say to the class, “One of the things that mathematicians do is use representations to help them solve math problems. Today you are going to use representations to solve math problems about batting averages. A baseball player’s batting average is calculated by dividing the number of times a player gets a hit by the number of times a player bats.”
* Ask students to think about what they already know about the decimal squares to help them solve the problem.

**Explore:**

3. Students work with a partner to find the difference between the batting averages of two players. Ensure students have access to several copies of the thousandths grids to represent the difference between several pairs of players. (If technology is available, students may also duplicate the hundredths grid and use the fill tool to shade boxes on the grid).

4. Observe students as they work and pose questions to check their understanding:

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| **Observation** | **Questions to Ask** |
| Students have difficulty representing the various problems on the thousandths grid. | * “If the entire square has a value of 1 what is the value of the smallest square?” * “How can we use the decimal grid to help us solve the task?” |
| Students do not know if they have to add or subtract the numbers. | * “How do we find the difference between two numbers? Can you use a number line to represent the two numbers? What do you notice? |
| Students have difficulty putting both numbers on the decimal grid. | * “How can you make sure you can see the 2 different quantities on your decimal grid?” |

**Discuss:**

5. Once students have completed Batting Averages – Part 1”, bring students together to discuss the questions (they need their activity sheets). Have pairs of students demonstrate how they used the grids to find the difference between the batting averages of their two players.

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| **Sample Questions** | **Possible Responses or Talk Frames** |
| How did you determine which decimal was greater? | * “I looked at Frederick and Romeo. Frederick’s average had a 3 in the hundredths place and Romeo’s average had a 2 in ~~it~~ the hundredths place, so Frederick’s batting average is greater.” |
| How did you estimate the differences in batting averages? | * “I knew the 0.349 was about 0.350 and that 0.258 was about 0.260. Since 0.260 is less than 0.100 away from 0.350, I think the difference will be about 0.090.” |
| How did you use the thousandth grid to represent the two decimals? | * “I knew that one row of the square was a tenth, one large square is a hundredth, and the smallest box is a thousandth. I just shaded the larger number and crossed out the amount of boxes for the smaller number. What was left was my answer.” * “I shaded one decimal on the left and one decimal starting on the right. I then crossed out the same amount from both pictures and what was left was the difference between the two players, so that was my answer.” |
| How did you determine your answer? | * “I counted all of the little boxes that were left over after I crossed out the number of boxes for the smaller number.” |

6. Ask students, “Let’s find the difference between Jamir’s and Tommy’s averages. Have students help model using the grids to show the difference OR have a student pair who chose Jamir and Tommy share their grid model. What is another way we could find the difference between their batting averages?”

Have students share. Possible responses could include: “We can subtract Jamir’s average from Tommy’s average so we are subtracting 327 hundredths from 346 hundredths.”

7. Have students share their strategies for finding the difference and record their thinking on the board. Be sure to elicit and use different representations for the computation. For example, a number line can be used to model adding up in chunks:

+ 0.010

+ 0.006

+ 0.003

0.340

0.346

0.330

0.327

* 1. 0.010 + 0.006 = 0.019. 0.019 is the difference in their batting averages.

8. Have students justify their answers. Ask: “How do you know your answer is reasonable?” and “How can you prove that your answer is correct?”

9. Ask students to summarize how they worked as mathematicians today. (1. Make sense of problems and persevere in solving them – We worked together to understand the problems and did not give up. 4. Model with mathematics – We used the decimal squares, a number line, and other representations to show what was happening in the problem. 6. Attend to precision – We estimated to make sure our answers were reasonable. We checked to make sure our answers were correct.)

**Additional Activities:**

These activities can either be done by everyone in the class or as part of centers/math workshop.

**More Batting Averages**

Students can work on the activity sheet More Batting Averages. You can pull students in small groups to support them by asking questions.

**Comparing Decimals**

Students need number cards. Students get 6 number cards and make two 3-digit decimal numbers 0. \_ \_ \_ and 0. \_ \_ \_. Students have to determine which decimal is greater and explain to their partner what place tells them which decimal is great. Example: for the numbers 0.352 and 0.365, a student may say, “365 thousandths is greater than 352 thousandths because 365 thousandths has more hundredths than 352 thousandths.”

**Decimal Differences**

Students need number cards. Students get 6 number cards and make two 3-digit decimal numbers 0. \_ \_ \_ and 0. \_ \_ \_. Students then use the thousandths grid or number lines to find the differences of the digits. Students can play with a partner and the one with the largest sum wins a point.

**Evaluation of Student Understanding:**

**Informal Evaluation:**

* Observe students and ask questions as they work on the Explore part of the lesson. Make note of specific strategies to have certain students share during the Discuss phase of the lesson.

**Formal Evaluation:**

* Students’ work on the Batting Averages activity sheet Part 2 for a formal evaluation.

**Meeting the Needs of the Range of Learners:**

**Interventions:**

* For students who struggle see the misconceptions and suggestions in the Explore task and below.

**Extensions:**

* This lesson provides a conceptual foundation of subtracting decimals to the thousandths place. Students in need of more of a challenge could work on two-step problems involving addition and/or subtraction of decimals.

**Possible Misconceptions/Suggestions:**

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| **Possible Errors**  **and Misconceptions** | **Suggestions** |
| Students have difficulty representing the various problems on the thousandths grid. | * “If the entire square has a value of 1 what is the value of the smallest square/unit?” * “How can we use the decimal grid to help us solve the task?” |
| Students do not know if they have to add or subtract the numbers. | * “What are some ways we can find the difference between two numbers?” |
| Students have difficulty putting both numbers on the decimal grid. | * “What are some ways you might represent the quantities on the grids? Can you represent 0.10? What about 0.50? 0.55? |

**Special Notes:**

* The *What Do You See?* Activity can be done at various times during the unit or cluster to launch a lesson.
* The Additional Activities can be done at various times during the unit or cluster.

**What Do You See?**

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**Batting Averages**

You can calculate a baseball player’s batting average by the number of times a player gets a hit divided by the number of times a player bats. Here are the batting averages for the West Side Wings baseball team.

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| **Player** | **Batting Average** |
| Jamir | 0.327 |
| Tommy | 0.346 |
| Romeo | 0.258 |
| Victor | 0.299 |
| Nic | 0.245 |
| Frederick | 0.349 |
| Denard | 0.367 |

**Part One:**

Pick two of the players from the baseball team.

Determine which batting average is greater and identify which place tells you which average is greater.

Estimate the difference between the batting averages to the nearest hundredth.

Find the difference between the batting averages using the thousandths grid. Write an explanation of your work below.

**Part 2:**

Pick two different players from the baseball team.

Determine which batting average is greater and identify which place tells you which average is greater.

Estimate the difference between the batting averages to the nearest hundredth.

Find the difference between the batting averages using the thousandths grid. Write an explanation of your work below.

**More Batting Averages**

You can calculate a softball player’s batting average by dividing the number of times a player gets a hit by the number of times a player bats. Here are the batting averages for the West Side Wings softball team.

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| **Player** | **Batting Average** |
| Julia | 0.354 |
| Tomika | 0.345 |
| Ryan | 0.352 |
| Isobel | 0.345 |
| Kate | 0.286 |
| Annabelle | 0.245 |
| Winnie | 0.255 |

**Part One:**

Pick two of the players from the baseball team.

Determine which batting average is greater and identify which place tells you which average is greater.

Estimate the difference between the batting averages to the nearest hundredth.

Find the difference between the batting averages using the thousandths grid. Write an explanation of your work below.

**Part 2:**

Pick two different players from the baseball team.

Determine which batting average is greater and identify which place tells you which average is greater.

Estimate the difference between the batting averages to the nearest hundredth.

Find the difference between the batting averages using the thousandths grid. Write an explanation of your work below.

Thousandths Grid

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Number Cards Page 1 of 2

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